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An economic and marketing analysis of coconut: Cocoa intercropping in West Godavari district of Andhra Pradesh

¹H Srinivasa Rao, ²R Saidhar and ³K Archana

¹Associate Professor & Head (Agril. Economics), Agricultural College, Rajamahendravaram, ANGRAU, Andhra Pradesh, India

²Field Supervisor, Cost of Cultivation Scheme, ANGRAU, Lam, Guntur, Andhra Pradesh, India

³Subject Matter Specialist, Department of Agril. Extension, KVK, VR Gudem, YSRHU, Andhra Pradesh, India

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Corresponding Author: H Srinivasa Rao

Abstract

This study was conducted to assess the economics of coconut and cocoa intercropping and to identify better marketing channels for both crops in West Godavari district of Andhra Pradesh. Initially, three tehsils with the highest area under this intercropping system were selected from the district, followed by the selection of two villages with the highest area under the system. From each tehsil, ten farmers practicing coconut and cocoa intercropping were randomly selected, resulting in a total sample size of 60 farmers for the study. Details regarding the cost of cultivation, marketing channels, and corresponding marketing costs incurred for both crops were collected and analyzed. Since coconut and cocoa are horticultural crops with an initial gestation period, the amortization technique was employed to account for the establishment costs incurred during the gestation period. The average number of coconut and cocoa plants per hectare in the study area was 155 and 408, respectively. The total cost of cultivation of coconut was Rs. 111,086 per ha, with gross returns of Rs. 189,005. Similarly, the total cost of cultivation of cocoa was Rs. 135,716 per ha, with an output value of Rs. 170,289. The total income from the coconut and cocoa intercropping system was Rs. 359,294, while the estimated total cost was Rs. 246,802, resulting in a B ratio of 1.46. Three marketing channels were identified for coconut: Producer–Consumer, Producer–Wholesaler–Retailer–Consumer, and Producer–Retailer–Consumer. In the case of cocoa, two marketing channels were identified: Producer–Wholesaler–Company Agent and Producer–Company Agent. The producer's share in the consumer's rupee was highest (100%) in the Producer–Consumer channel for coconut and the Producer–Company Agent channel for cocoa, compared to the other marketing channels.

Keywords: Coconut, Cocoa, intercropping, Amortization, BCR, marketing channel

1. Introduction

Coconut (*Cocos nucifera*) is a traditional plantation crop with diverse uses, providing food, medicine, health beverages, shelter, fuel, timber, and several other products. In the world, India stood at third place in terms of area just behind Philippines and Indonesia. In India, coconut occupied an area of 21.94 Lha during 2024-25 with a production of 20301 million nut with a productivity of 9249 nuts/ha. The major share of area (about 90%) of coconut plantations is concentrated in the four southern states, namely Kerala (754000 ha), Karnataka (600790 ha), Tamil Nadu (505530 ha) and Andhra Pradesh (108480 ha). However, Karnataka ranked first in terms of production (5488.40 million nuts) despite second in area. Andhra Pradesh stood first in yield with 16002 nuts/ha (<https://coconutboard.gov.in>). Likewise, cocoa crop also majorly occupied in above four southern states. However, cocoa crop had highest area in Andhra Pradesh (47058 ha) followed by Tamil Nadu (33355 ha), Kerala (19219 ha) and Karnataka (14407 ha) (<https://dccd.gov.in>). Coconut cultivation is predominantly undertaken by small and marginal farmers, with the average holding size being only 0.22 ha. Consequently, the income

generated from coconut plantations alone is often inadequate to meet even the basic needs of small farm families.

Coconut is amenable to both monocropping and intercropping systems, as the relatively wide spacing between coconut palms permits the cultivation of other crops in the interspaces. Under the traditional monocropping system, coconut cultivation can provide employment for only about 100–120 days per annum. Furthermore, the recommended spacing of 7.5 m × 7.5 m between coconut palms accommodates nearly 175 plants per ha, which results in suboptimal utilization of available soil, water, and nutrient resources (Dhanapal, 2010) ^[3]. Being a perennial crop, coconut occupies the land for several decades, while a considerable portion of the available resources and interspaces remains underutilized. Therefore, coconut plantations offer considerable scope for intercropping, providing an opportunity to enhance farm income and generate employment throughout the year.

The success of any intercropping system largely depends on the compatibility between the component crops. Among the various coconut-based intercropping systems, cocoa appears to be one of the most promising combinations. Cocoa, being

a shade-loving crop, is ideally suited for intercropping with mature coconut plantations, where the coconut canopy can provide the shade required for optimum cocoa growth. In addition, cocoa cultivation has the potential to provide year-round employment opportunities to farm households (Maheswarappa *et al.*, 2010) [7].

In Andhra Pradesh, the Godavari districts account for more than 70 per cent of the total area under coconut cultivation. Erstwhile West Godavari district is one of the major potential areas for coconut cultivation and ranked second after erstwhile East Godavari district in terms of area and production. The area under coconut in West Godavari increased from 21,561 ha during 2014–15 to 25,975 ha during 2020–21. In the year 2021–22, districts were reorganized and increased to 26 from 13. Hence, few tehsils were shifted to newly formed district. Even then, the area under coconut in West Godavari increased from 5107 ha in 2022–23 to 8936 ha in 2024–25.

West Godavari is also the district with the highest acreage under cocoa cultivation. The area under cocoa increased from 12,685 ha during 2014–15 to 22,015 ha during 2020–21. Even after reorganization, cocoa crop has considerable area as intercrop with coconut. Cocoa is rarely cultivated as a monocrop because of its requirement for shade during growth and development. Consequently, coconut plantations provide a suitable environment for cultivating cocoa as an intercrop. The coconut–cocoa intercropping system is predominantly found in West Godavari district of Andhra Pradesh, unlike other districts where combinations such as coconut–oil palm, coconut–banana, coconut–nutmeg, *etc.*, are commonly observed.

In view of the considerable potential of the coconut–cocoa intercropping system in the district, a study entitled “An economic and marketing analysis of coconut–cocoa intercropping system in West Godavari district of Andhra Pradesh” was undertaken with the following objectives.

1. To examine the cost return structure of coconut–cocoa intercropping
2. To identify the major marketing channels of coconut and cocoa
3. To find out the major constraints in production and marketing

2. Methodology

Secondary data pertaining to both coconut and cocoa crops were collected from the official website of the Department of Horticulture (horticulture.ap.nic.in), which revealed that West Godavari district had the highest combined area under coconut and cocoa cultivation. Based on the area under this intercropping system, three tehsils with the highest coverage were selected from West Godavari district. Subsequently, two villages were selected from each tehsil, and ten farmers were randomly selected from each village, resulting in a total sample size of 60 farmers for the study. Primary data were collected from the selected farmers using a well-structured schedule.

The cost of cultivation for both coconut and cocoa crops was estimated following the methodology prescribed by the Commission for Agricultural Costs and Prices (CACP).

Computation Cost and Returns

The costs incurred were broadly categorized in to 2 classes

1. Variable/operational/working costs
2. Fixed costs

2.1 Total Variable Costs (TVC)

It includes costs incurred on seed, manures and fertilizers, plant protection chemicals (PPCs), human labour charges, bullock labour charges, machine labour charges and interest on working capital.

TVC: Value of human labour (both owned and hired)
 + Value of bullock labour (both owned and hired)
 + Value of machinery power (both hired and owned)
 + Value of seedlings (both purchased and owned)
 + Value of seed treatment chemical
 + Value of insecticides and pesticides
 + Value of weedicides
 + Value of manure (both owned and purchased)
 + Value of fertilizers
 + Value of irrigation charges
 + Interest on working capital

The terms used in computing the total variable costs are described below.

- a. **Seedling:** Seedlings produced by the farmers themselves (own seedlings) were valued at the prevailing market prices at the time of crop establishment. Purchased seedlings were valued based on the actual prices paid by the sample respondents.
- b. **Farm Yard Manure:** Farm Yard Manure obtained from the farmers' own resources was valued at the prevailing prices in the respective villages. In the case of purchased FYM, the actual prices paid by the sample respondents were considered for valuation.
- c. **Human labour:** Human labour comprised both hired labour and family labour. The wage rates prevailing in the study area for hired male and female labour were used for valuation. Since the wage rates and work efficiency differed between male and female labour, women labour days were converted into male labour days using the conversion ratio of 3 women labour days to 2 man days, i.e., one woman labour day was considered equivalent to 0.66 man day. Family labour was valued at the prevailing wage rates applicable to hired labour of the corresponding category.
- d. **Bullock labour:** Bullock labour was valued based on the prevailing hiring charges for a pair of bullocks in the respective villages. The same prevailing hiring rate was applied for valuing the services of owned bullocks used by the sample farmers.
- e. **Machine labour:** Machine labour was valued on an hourly basis. The prevailing hiring charges for agricultural machinery in the respective villages were considered for estimating the cost of machine labour, irrespective of whether the machinery was hired or owned.
- f. **Fertilizers and Plant Protection Chemicals (PPCs):** Based on the actual prices paid by the sample respondents, these values were taken.
- g. **Irrigation charges:** Total amount paid to the water for irrigation during entire crop period were considered.
- h. **Interest on working capital:** Interest on working capital was calculated at 7 per cent per annum, corresponding to the rate at which financial institutions provide short-term

loans. Since the expenditure on various inputs was incurred at different stages throughout the crop period, interest on working capital was charged for half of the crop period.

2.2 Total Fixed Costs (TFC)

It includes land revenue/cess, rental value of land, depreciation on farm implements and buildings, interest on fixed capital investment and amortized costs on establishment capital (for perennial crops).

TFC: Rental value of land

- + Land revenue/cess/other taxes
- + Depreciation on farm implements and buildings
- + Amortized costs on establishment capital (Perennial crops)
- + Interest on fixed capital

The terms used in computing the total fixed costs were described below.

- a. **Land revenue/cess/other taxes:** They were considered as per the rates prescribed by the Government.
- b. **Rental value of land:** It varies with situation to situation. Hence, actual rental value prevailing in the village was considered.
- c. **Depreciation:** The life span, junk value and original value of the machinery or implement or building were decided in consultation with the respondent. The depreciation was calculated based on straight line method as shown below

$$\text{Annual depreciation} = \frac{\text{Original Value} - \text{Junk Value}}{\text{Life span}}$$

If machinery or implement used for more number of crops, the depreciation amount was apportioned based on area under crops.

- d. **Amortization:** In case of perennial crops, returns were received after gestation period of the crop. Hence, the establishment investment during the initial years of the crop were amortized by using the following formula and added in fixed cost component.

$$A = \frac{P \times i (1+i)^n}{(1+i)^n - 1}$$

Where

A = Amortized cost

P = Initial investment made on establishment

i = Interest rate (10% per annum)

n = Economic life span

- e. **Interest on fixed capital:** It was calculated by taking an interest rate of 10 per cent on value of fixed assets such as machinery, implements, irrigation structures etc.

2.3 Total Cost (TC)

It was the sum of total fixed costs and total variable costs.

$$TC = TVC + TFC$$

2.4 Returns

The gross returns were estimated based on the actual price

received by the farmer for the produce sold in the market. The same prevailing price was used to impute the value of the produce retained by the farmer for home consumption. Gross returns comprised the value of both the main product and by-product. The net returns were calculated by deducting the total cost of cultivation from the gross returns.

2.5 Benefit Cost Ratio (BCR)

$$BCR = \text{Total Returns} / \text{Total Costs}$$

2.6 Computation of Marketing efficiency

- a. **Marketing channel:** These are routes through which produce moving from producer to consumer.
- b. **Marketing costs:** It is actual expenses incurred in moving produce from producer to consumer. It can be computed by

$$TC = C_P - \sum_{i=1}^n MC_i$$

Where

TC = Total cost of marketing

C_P = Costs incurred by producer in marketing

MC_i = Marketing costs incurred by ith trader.

- c. **Marketing margins:** It is difference between price paid and received by a specific marketing functionary. It can be computed by

$$A_m = P_m - (P_b + M_c)$$

Where A_m = margin of middle men or trader

P_m = selling price of trader

P_b = buying price of trader

M_c = marketing costs borne by trader

- d. **Price spread:** It is difference between price paid by consumer and price received producer. It can be computed by

$$P_s = (P_C - P_P)$$

Where P_s = Price spread

P_C = Price paid by the consumer

P_P = Price received by the consumer

- e. **Producers share in consumer rupee:** It is the percent of rupee received by the producer from the final consumer of the product. It can be calculated by

$$P = (P_P / P_C) \times 100$$

Where P = Producers share in consumer rupee

P_P = Price received by the producer

P_C = Price paid by the consumer

- f. **Marketing efficiency:** A marketing channel is efficient when producers share in consumer rupee is highest.

To know the major constraints, farmers were asked to rank the most common problems they are facing while cultivating the crops and marketing the produce.

3. Results and Discussion

3.1 Economics of coconut-cocoa intercropping

The results presented in Table 1 revealed that the total cost of cultivation of coconut and cocoa was Rs. 111,086 and Rs. 135,716, respectively. In coconut cultivation, variable costs and fixed costs accounted for Rs. 47,133 (42.42%) and Rs. 63,953 (57.58%), respectively. In the case of cocoa, variable costs amounted to Rs. 61,497 (45.31%), while fixed costs were Rs. 74,219 (54.69%). Thus, the proportion as well as the absolute value of variable costs was relatively higher in cocoa than in coconut.

The higher variable cost incurred in cocoa cultivation can primarily be attributed to the requirement of repeated harvesting and post-harvest operations such as drying. In contrast, coconut harvesting was undertaken at comparatively longer intervals of 45 days to two months, thereby reducing the frequency and associated labour expenditure. Cocoa also requires relatively intensive crop management practices, particularly frequent pruning and other intercultural operations, which contribute to its higher variable cost.

The gross returns and net returns obtained from coconut cultivation were Rs. 189,005 and Rs. 77,919, respectively. In comparison, cocoa cultivation generated gross returns of Rs. 170,289 and net returns of Rs. 34,573, respectively. The higher net returns from coconut were mainly attributable to its comparatively lower variable costs and lower expenditure on crop maintenance after completion of the gestation period. Once the coconut plantation reaches the bearing stage, its

maintenance requirements are relatively lower than those of cocoa. Cocoa, on the other hand, requires more intensive management, including frequent pruning and harvesting operations, which increases the cost of cultivation.

Considering the coconut-cocoa system as a whole, the total cost of cultivation was Rs. 246,802, while the corresponding gross returns amounted to Rs. 359,294. Consequently, the intercropping system generated a net income of Rs. 112,492. The Benefit-Cost Ratio (BCR) of the coconut-cocoa intercropping system was 1.46, indicating that every rupee invested in the system generated Rs. 1.46 in gross returns. The individual BCRs for coconut and cocoa were 1.70 and 1.25, respectively, demonstrating that both crops were economically viable, although coconut provided relatively higher economic returns.

Apart from enhancing farm income, the coconut-cocoa intercropping system also generated substantial employment opportunities. Under coconut cultivation alone, the number of employment days generated was only 67.8 man-days. The inclusion of cocoa as an intercrop generated an additional 143.7 man-days of employment for the farmers. Thus, the coconut-cocoa intercropping system not only improved the net income of farm households but also substantially increased labour utilization and provided employment opportunities throughout the year. The system therefore offers an economically viable strategy for better utilization of land and farm resources while simultaneously enhancing income and employment opportunities for coconut-growing farmers.

Table 1: Cost return structure of Coconut-Cocoa intercropping (Rs/ha)

Particulars	Coconut		Cocoa	
	Quantity	Value (Rs)	Quantity	Value (Rs)
Variable Costs				
Human labour	67.8 MD	33257	143.7 MD	46559
Machine labour	1.68 hrs	1892	2.05	2065
FYM	1.93 t	2006	2.02 t	2124
Fertilizers	465.67 Kgs	4972	251.5 kgs	2344
PPCs	5.6 lts	1902	8.54 lts	2768
Irrigation	15.67 No.	1578	20.25 No.	3557
Interest on working capital	@7%	1526	@7%	2080
Total variable cost (TVC)		47133 (42.42%)		61497 (45.31%)
Fixed Costs				
Depreciation		375		624
Land cess		75		
Rental value of land		52715		60016
Amortized cost		4974		6832
Interest on fixed capital	@10%	5814	@10%	6747
Total Fixed Costs (TFC)		63953 (57.58%)		74219 (54.69%)
Total Cost (TVC+TFC)		111086 (100%)		135716
Out put	19895 nuts	@9.50 per nut	1013 kgs	@168 per kg
Gross returns		189005		170289
BCR		1.70		1.25

* MD= Man days, hrs= hours, t= tons, kgs= kilograms, lts= litres, No.= Numbers and figures in parenthesis are percentage to total

3.2 Marketing channels, margins, price spread and efficiency of coconut-cocoa intercropping

3.2.1 Marketing channels identified for Coconut crop

A total of three marketing channels were identified for coconut produce marketing. They were

1. Producer -----→ Consumer (10% or 6 No.)
2. Producer -----→ Wholesaler -----→
Retailer -----→ Consumer (63.33% or 38 No.)

3. Producer -----→ Retailer -----→
Consumer (26.66% or 16 No.)

Nearly 63.33 percent (38) were used channel - 2 for marketing their produce followed by channel - 3 (26.66%) and channel - 1 (10%). Only small farmers preferred channel - 1 as they put small stalls besides highways for marketing the nuts.

Table 2: Marketing costs, margins and percent share of producer in different channels of Coconut crop

Particulars	Channel -1	Channel 2	Channel 3
Price received by producer/farmer	Rs. 15 per nut	Rs. 8.50 per nut	Rs. 8.50 per nut
Costs incurred by producer	Rs. 1.75 per nut		
Margin to producer	Rs. 13.25 per nut		
Marketing Costs incurred by wholesaler		Rs. 3.20 per nut	
Price received by wholesaler/price paid by retailer		Rs. 14.25 per nut	
Margin of wholesaler		Rs. 2.80 per nut	
Marketing Costs incurred by retailer		Rs. 1.10 per nut	Rs. 4.75 per nut
Price received by retailer or price paid by consumer	Rs. 15 per nut	Rs. 18.50 per nut	Rs. 20 per nut
Margin to retailer		Rs. 3.15 per nut	Rs. 6.75 per nut
Producers share in consumer's rupee (%)	100%	45.95%	Rs. 42.50

The results presented in Table 2 clearly indicated that Channel-I was the most advantageous marketing channel for coconut, as the producer's share in the consumer's rupee was 100 per cent. Under this channel, farmers sold the coconut nuts directly to consumers, thereby eliminating the involvement of intermediaries such as wholesalers and retailers. The absence of intermediaries enabled producers to retain the entire price paid by consumers. Wholesalers and other middlemen generally showed limited interest in this channel because individual farmers had relatively small marketable surpluses, making bulk procurement difficult.

In Channel-II, wholesalers directly approached farmers and purchased coconut nuts in bulk quantities. This channel was generally preferred by large farmers who had a relatively higher marketable surplus and could supply larger quantities at a time. The involvement of wholesalers facilitated the disposal of bulk quantities and reduced the marketing burden on farmers, although it resulted in a lower share of the consumer's rupee compared with direct marketing.

Channel-III was found to be the least marketing-efficient channel, with the producer's share in the consumer's rupee being only 42.50 per cent. The relatively lower producer share can be attributed to the involvement of multiple market intermediaries and the associated marketing costs and margins. Thus, the findings suggest that direct marketing through Channel-I was the most beneficial to producers in terms of price realization, while the choice of channel largely depended on the quantity of marketable surplus available with the farmers and their ability to directly access consumers.

3.2.2 Marketing channels identified for Cocoa crop

A total of two channels were identified for cocoa produce

marketing in the study area.

1. Producer -----> Wholesaler -----> Cadbury Com. Agent (85% or 51 No.)
2. Producer -----> Cadbury Com. Agent (15% or 9 No.)

The results presented in Table 3 revealed that Channel-II was more efficient than Channel-I in the marketing of cocoa. Unlike the marketing pattern observed for coconut, large cocoa farmers were directly approached by Cadbury company agents because of their relatively higher marketable surplus. Direct procurement by company agents enabled these farmers to realize better returns by reducing the involvement of intermediaries in the marketing process.

In contrast, Channel-I was predominantly used by small farmers, who generally had a relatively lower marketable surplus. Due to the small quantities available with individual farmers, company agents were reluctant to procure directly from them, as direct procurement involved higher transaction and collection costs. Consequently, middlemen played an important role in this channel by purchasing small quantities of cocoa from individual farmers, aggregating the produce into larger lots, and subsequently selling the consolidated quantities to company agents.

Thus, the greater efficiency of Channel-II can be attributed primarily to the direct linkage between producers and company agents, which reduced the number of intermediaries and associated marketing costs. However, Channel-I also served an important function by facilitating the aggregation and marketing of small quantities produced by smallholder farmers.

Table 3: Marketing costs, margins and percent share in producer in different marketing channels of cocoa crop

Particulars	Channel -1	Channel 2
Price received by producer/farmer	Rs. 160 per kg	Rs. 168 per kg
Marketing Costs incurred by wholesaler	Rs. 2.50 per kg	
Price received by wholesaler/price paid by company agent	Rs. 170 per kg	Rs. 168 per kg
Margin of wholesaler	Rs. 7.50 per kg	
Producers share in consumer's rupee (%)	94.12%	100%

3.3 Constraints in production and marketing

The major production and marketing constraints faced by the sample farmers are presented in Table 4. Among the production constraints, labour scarcity was reported by 100 per cent of the farmers, making it the most prominent constraint in coconut-cocoa cultivation. The shortage of labour increased the dependence on hired labour and

consequently resulted in higher wage rates, which was identified as the second most important constraint by 91.67 per cent of the farmers. The increased cost of labour directly contributed to the rise in the overall cost of cultivation and thereby reduced farm profitability.

Monkey and rat damage, reported by 86.67 per cent of the farmers, constituted the third major production constraint.

These pests caused considerable damage, particularly during the flowering and early fruit-development stages. Monkeys and rats often plucked or damaged unripe fruits from the trees, resulting in a minimum yield loss of 10 per cent. Such losses not only reduced physical output but also adversely affected the returns obtained by farmers.

Among the marketing constraints, non-remunerative prices for the produce were reported by 100 per cent of the farmers, making it the most significant marketing constraint. This was followed by high transportation charges, reported by 85 per cent of the farmers. The high cost of transporting produce to markets reduced the net price realized by farmers,

particularly those with small marketable surpluses.

A further concern was that most farmers sold their coconut nuts primarily for water purposes, for which they were unable to obtain the Minimum Support Price (MSP) for their produce. Consequently, despite incurring considerable production and marketing costs, farmers often received prices that were perceived as non-remunerative. The findings therefore highlight the need for measures to address labour shortages, minimize pest-related losses, improve transportation facilities, and strengthen remunerative market linkages for coconut and cocoa producers.

Table 4: Major production and marketing constraints in Coconut-Cocoa intercropping

S. No.	Production constraints	Percentage of respondents	Rank
1	Labour scarcity	100	1
2	High wages of labour	91.67	2
3	Pest and disease incidence	70	4
4	Monkey & rat damage	86.67	3
5	Lower yields	50	5
	Marketing Constraints		
1	Non remunerative price	100	1
2	High transportation charges	85	2
3	Improper grading	58.33	4
4	Mal practices by middle men	50	5
5	Low bargaining power	75	3

4. Conclusion

The coconut–cocoa intercropping system is highly profitable compared with other intercropping combinations commonly practiced in coconut plantations. Consequently, the area under this intercropping system has been gradually increasing over the years in West Godavari district. Despite its economic potential, the system is confronted with several production and marketing constraints. Labour scarcity and damage caused by monkeys were identified as the major production constraints, while non-remunerative prices and high transportation costs emerged as the major marketing constraints. The Forest Department should take appropriate measures to control monkey damage in coconut and cocoa plantations, as monkeys frequently pluck and damage unripe fruits, resulting in considerable yield losses and reduced profitability for farmers. Appropriate preventive and management measures could help minimize these losses and improve farm-level returns. The Department of Horticulture should encourage farmers to adopt copra production and marketing, as farmers in the region predominantly sell coconut nuts for fresh-water consumption. Unlike fresh coconuts sold for water purposes, copra is covered under the Minimum Support Price (MSP) mechanism. Promoting copra production and facilitating access to assured markets could therefore help protect farmers from distress sales and improve price realization. Such measures would strengthen the economic viability of the coconut–cocoa intercropping system and further encourage its adoption among farmers in the region.

5. Policy recommendations

The researchers can undertake further studies to evaluate different planting methods and assess their corresponding economic benefits. In addition, there is an urgent need to develop effective measures for controlling monkey and rat

damage, as these pests alone are responsible for nearly 10 per cent crop losses.

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